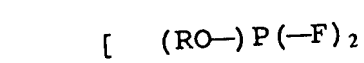
ETHYL

Serial No. 07/714,441

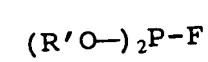
APPENDIX 1

1. An aromatic fluorophosphorus compound suitable for use as an antioxidant said compound being selected from fluorophosphorus compounds having the structure:



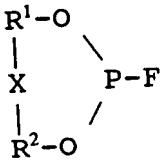
Formula V

wherein R is an substituted aryl group wherein the substituents are tert-alkyl groups:



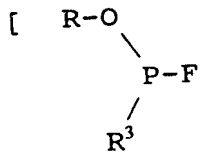
Formula VI

wherein R' is a substituted aryl group wherein the substituents are selected from sec-alkyl, tert-alkyl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, acyloxy, and alkoxy carbonyl alkyl:]



Formula II

wherein R^1 and R^2 are substituted or unsubstituted [aryl] phenyl groups wherein the [substituent] substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, [hydroxy,] alkoxy, aryloxy, and halo[:], and X is selected from the group consisting of a single bond connecting R^1 and R^2 and divalent bridging groups selected from divalent aliphatic hydrocarbon groups containing 1-12 carbon atoms, —O— and $-S_q-$ wherein q is an integer from 1 to 3[:], and wherein aryl is selected from the group consisting of phenyl, o-tolyl, p-tolyl, naphthyl, 4-phenylphenyl and 4-sec-hexylphenyl.



Formula III

wherein R is a substituted or unsubstituted aryl group wherein the substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, alkoxycarbonyl, alkoxycarbonyl-alkyl and acyloxy, and R^3 is selected from the group consisting of alkyl, cycloalkyl, aralkyl, aryl, substituted aryl, alkoxy, cycloalkoxy and aralkoxy; and

formula. One highly preferred class of such compounds can be represented by the formula:

$(RO-)_nP(-F)_{3-n}$ Formula I

wherein R is a [substitute] substituted or unsubstituted aryl group wherein the substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, alkoxycarbonyl, alkoxycarbonylalkyl an acyloxy and n is 1 or 2. In a still more preferred embodiment of this class of compounds the substituents are alkyls having [1-carbon] 1-20 carbon atoms, aryls having 6-12 carbon atoms, arylalkyls having 7-12 carbon atoms, cycloalkyls having 5-8 carbon atoms, hydroxy, alkoxy having 1-12 carbon atoms, aryloxy having 6-12 carbon atoms, halo, alkoxycarbonylalkyl having 1-20 carbon atoms in its alkoxy moiety and 1-3 carbon atoms in its alkyl moiety, alkoxy carbonyl having 1-20 carbon atoms in its alkoxy moiety and acyloxy having 1-4 carbon atoms.

Representative examples of the above substitutents are methyl, isopropyl, sec-butyl, tert-butyl, n-decyl, sec-dodecyl, sec-eicosyl, phenyl, o-tolyl, p-tolyl, naphthyl, 4-phenylphenyl, 4-sec-hexylphenyl, benzyl, alpha-methylbenzyl, phenethyl, 4-tert-butylbenzyl, 4-tert-butyl-alpha-methylbenzyl, cyclopentyl, cyclohexyl, cyclooctyl, methoxy, ethoxy, isopropoxy, 2-ethylhexoxy, 2-ethoxyethoxy, isobutoxy, dodecoxy, phenoxy, 4-ethylphenoxy, napthoxy, 4-phenylphenoxy, chloro, bromo, fluoro, iodo, methoxycarbonylmethyl, butoxycarbonylethyl, dodecyloxycarbonylpropyl, octadecyloxycarbonylethyl, icosyloxycarbonylethyl, methoxycarbonyl, butoxycarbonyl, decyloxycarbonyl, octadecyloxycarbonyl, icosyloxycarbonyl, formate, acetyloxy, propionyloxy, butyryloxy and the like.

Representative examples of the group (RO) include phenoxy, 2-methyl-6-tert-butylphenoxy, 2,4-di-tert-butylphenoxy, 2,6-diisopropylphenoxy, 2,4-diisopropylphenoxy, 2,6-di-secbutylphenoxy, 4-phenylphenoxy, 2-(alpha-methylbenzyl)phenoxy 2,6-di(alpha-methylbenzyl)phenoxy, 2-cyclohexylphenoxy, 2-methyl-4-cyclohexylphenoxy, 4-hydroxyphenoxy, 4-methoxyphenoxy, 2-ethoxyphenoxy, 4-dodecyloxyphenoxy, 4-phenoxyphenoxy, 4-octadecyloxycarbonylethyl-2,6-di-tert-butylphenoxy, -dodecyloxycarbonylpropyl, 4-acetyloxyphenoxy and the like.

Some representative compounds of Formula I are: bis(2, 6-di-tert-butylphenyl) fluorophosphite; 2,6-di-tert-butylphenyl difluorophosphite; bis(2,4-di-tert-butylphenyl) fluorophosphite; 2,4-di-tert-butylphenyl difluorophosphite; bis(4-(2-octadecyloxycarbonylethyl)-2,6-di-tert-butylphenyl) fluorophosphite;

(aka bis[2,6-di-tert-butyl-4-(2-carbooctadecyloxyethyl)phenyl]fluorophosphite); 4-(2-octadecyloxycarbonylethyl)-2,6-di-tertbutylphenyl difluorophosphite; bis(4-(2-dodecyloxycarbonylethyl)-2,6-di-sec-butylphenyl) fluorophosphite and the like.

The most preferred compounds in Formula I are: bis(2,6-di-tert-butylphenyl) fluorophosphite: bis(2,4-di-tert-butylphenyl) fluorophosphite and bis(4-(2-octadecyloxycarbonylethyl)-2,6-di-tert-butylphenyl) fluorophosphite.

A second highly preferred class of compounds of the invention are the cyclic fluorophosphites having the structure